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Emission Tests on a Vespa 125 cc Primavera Scooter

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16. Abstract: Vespa scooter models were of interest to EPA because of their unique body design (and thus possibly different road load characteristics) and because of recent advertised claims of lower pollutant levels. Tests were performed at the EPA Emissions Laboratory in Ann Arbor, Michigan. The test procedure for this motorcycle consisted of coast down tests to determine road load horsepower, followed by emission tests. The modified driving cycle for motorcycles with displacements less than 170cc was used. The motorcycle was capable of following all portions of the driving cycle. The average mass emissions along with the proposed interim and final motorcycle emission standards are presented.

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BACKGROUND

In the fall of 1975 EPA contacted a local Vespa motorcycle dealer with the intention of leasing a Vespa for testing purposes. The Vespa scooter models were of interest to EPA because of their unique body design (and thus possibly different road load characteristics), and because of recent advertised claims of 'exhaust pollutants almost entirely eliminated' (Ref. 1 and 2). As a result of our inquiry, the local dealer contacted the distributor and a 1976 Vespa 125 Primavera was made available to EPA for testing.

The Environmental Protection Agency receives information about many systems which appear to offer potential for emission reduction or fuel economy improvement compared to conventional engines and vehicles. EPA's Emission Control Technology Division is interested in evaluating all such systems, because of the obvious benefits to the nation from identification of systems that can reduce emissions, improve economy, or both. Tests are performed at the EPA Emissions Laboratory in Ann Arbor, Michigan, and the results of all such tests are set forth in a series of reports.

The conclusions from the EPA evaluation tests can be considered to be quantitatively valid only for the specific test vehicle used, however, it is reasonable to extrapolate the results from the EPA test to other types of vehicles in a directional or qualitative manner, i.e., to suggest that similar results are likely to be achieved on other types of vehicles.

VEHICLE DESCRIPTION

The motorcycle tested was a 1976 Vespa 125 Primavera scooter with 195 miles on the odometer. The engine is a single horizontal cylinder, two stroke, carbureted engine of 121.1/cc displacement. A tag on the vehicle certifies the power does not exceed 5 brake horsepower (no specific power is specified.)

The motorcycle was inspected and tuned by a Vespa factory representative prior to delivery to EPA.

TEST PROCEDURE

The test procedure for this motorcycle consisted of coast down tests to determine road load horsepower, followed by emission tests.

The Vespa was taken to the Transportation Research Center of Ohio (TRC) for coast down tests. In a coast down test, the vehicle is accelerated to a constant speed, the clutch is disengaged, and the vehicle is allowed to coast with the road, vehicle, and aerodynamic forces slowing the vehicle. Ten coast downs, five in each direction, were performed. The velocity was measured by a radar unit and was recorded on magnetic tape along with the time and wind history. The data were processed using

a least squares curve fitting method which yielded a composite equation for the road load force.

The road load power determined from the coast down tests is shown in Figure 1. Also shown in this figure is the dynamometer power absorption curve which results from using the road load power value specified in the NPRM (Reference 3) for the Vespa's Inertia category (2.53 kw at 65 kph for a 160 kg equivalent inertial mass). The curves show that the Vespa has a slightly lower road load power requirement in the 40-60 kph range than a 'standard' 160 kg equivalent inertial mass motorcycle.

For the Vespa emissions tests, a lower total absorbed power than specified in the NPRM was used. The lower absorbed power is based on the actual road power determined from the coast down tests. The normal procedure is to set the dynamometer power at 65 kph, however for the Vespa the power was set at 50 kph. The top speed of the Vespa, as determined at TRC, is 76 kph. Limited by the top speed, the coast downs occurred over a usable range of 65 to 25 kph. To avoid extrapolation of the coast down results, the road power at 50 kph was determined and this value, minus the dynamometer friction was set on the dynamometer power absorber. A summary of the road load powers is presented in Table I.

TABLE I

Road Load Power at 50 kph

As specified in NPRM	1.35 kw(1)
As determined from coast downs	1.15 kw
Power used for dyno tests	1.15 kw

Figure 2 presents a comparison of the road load power of the motorcycle and the power absorbed by the dynamometer. The absorbed power in both cases is 1.15 kw at 50 kph. The comparison shows that the dynamometer absorbed power is slightly less at most velocities than the road load power determined from the coast downs.

(1) Determined from Figure 1. The NPRM specified 2.53 kw at 65 kph.

TEST RESULTS AND CONCLUSIONS

Two tests accomplished per the NPRM procedures were performed. Test conditions were 1.15 kw total absorbed power at 50 kph with 160 kg inertia. The modified driving cycle for motorcycles with displacements less than 170 cc was used. The motorcycle was capable of following all portions of the driving cycle. The average mass emissions are presented in Table II along with the proposed interim and final motorcycle emission standards.

Figure 1

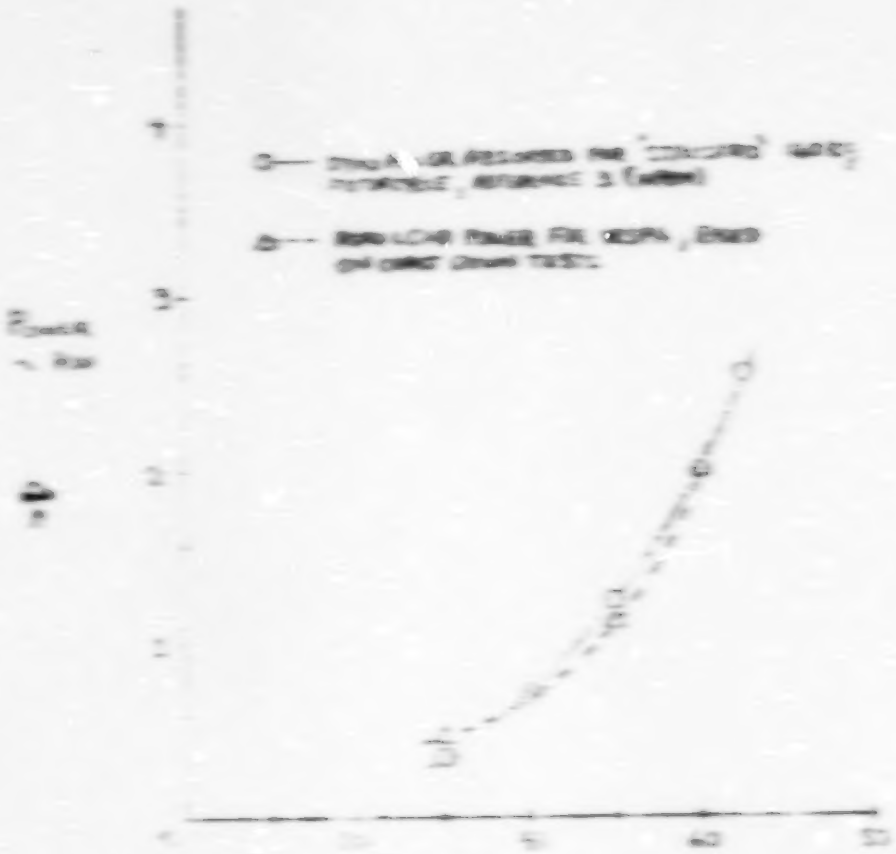


Figure 2

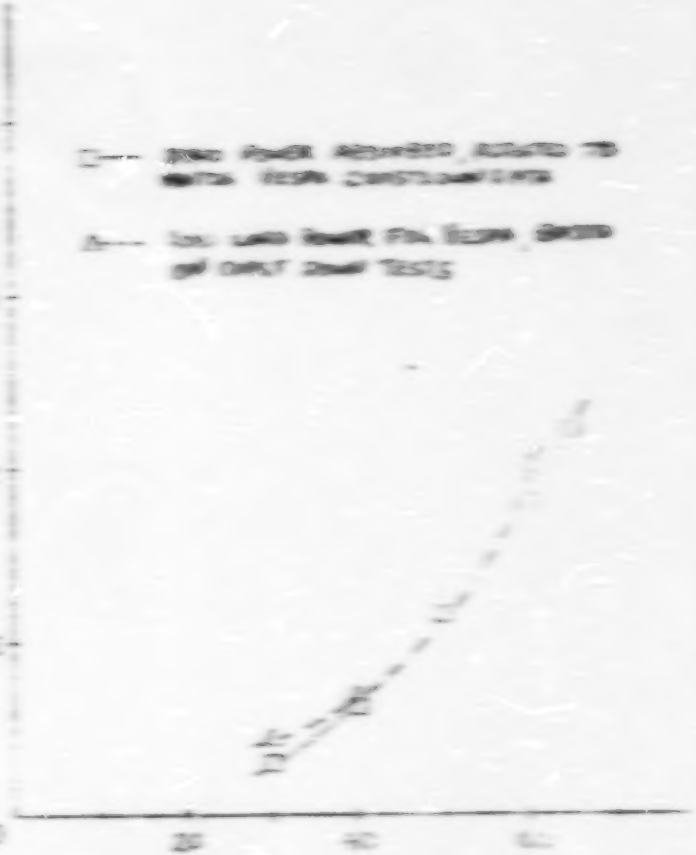


TABLE II

Mass Emissions - Vespa 125

(Grams per kilometer)

	HC	CO	NO_x	Economy, Km/l
Test # 2605	4.71	13.3	.04	33
Test # 2619	4.82	12.3	.03	34
Average	4.77	12.8	.04	34
1978 Standard	5.0	17	1.2	-
1980 Standard	0.25	2.1	0.25	-

The motorcycle tested meets the 1978 interim standardsbut exceeds the 1980 standards by factors of 19 for HC and 6 for CO.

Table III compares the Vespa test data with similar motorcycles and with light duty vehicles.

TABLE III

Comparisons with Other Vehicles

(Grams per Kilometer)

	HC	CO	NO_x
Vespa 125	4.8	12.8	.03
Range for similar motorcycles (1)	4.6-8.5	5-15	.02-.10
1972 LDV Standard	2.1	24	1.9
1975 LDV Standard	.93	9.3	1.9

(1) Range is for other single cylinder 2 stroke motorcycles of approximately 125 cc displacement, based on EPA and industry test results.

Table III indicates that the Vespa's emissions are typical of other single cylinder two stroke engines of similar displacement. When compared to controlled light duty vehicle standards, the Vespa emits 3 times more HC and 1.4 times more CO than the 1975 Light Duty Standard. NO_x emissions are only one sixth the standard, and fuel economy is much better than most light duty vehicles. The claim, however, that Vespa emissions are almost entirely eliminated is not justified when compared to other similar motorcycles or controlled light duty vehicles.

REFERENCES:

1. Wall Street Journal - Eastern Edition, Friday, August 15, 1975, Page 3.

2. T.V. Guide - Southeast Michigan Edition, September 6-12, 1975, Page A-49.

3. Federal Register, Vol. 40, No. 205, October 22, 1975, pages 49490-49510.

APPENDIX I

TEST VEHICLE DESCRIPTION

1974 VESPA 125 PRIMAVERA SCOOTER

ENGINE

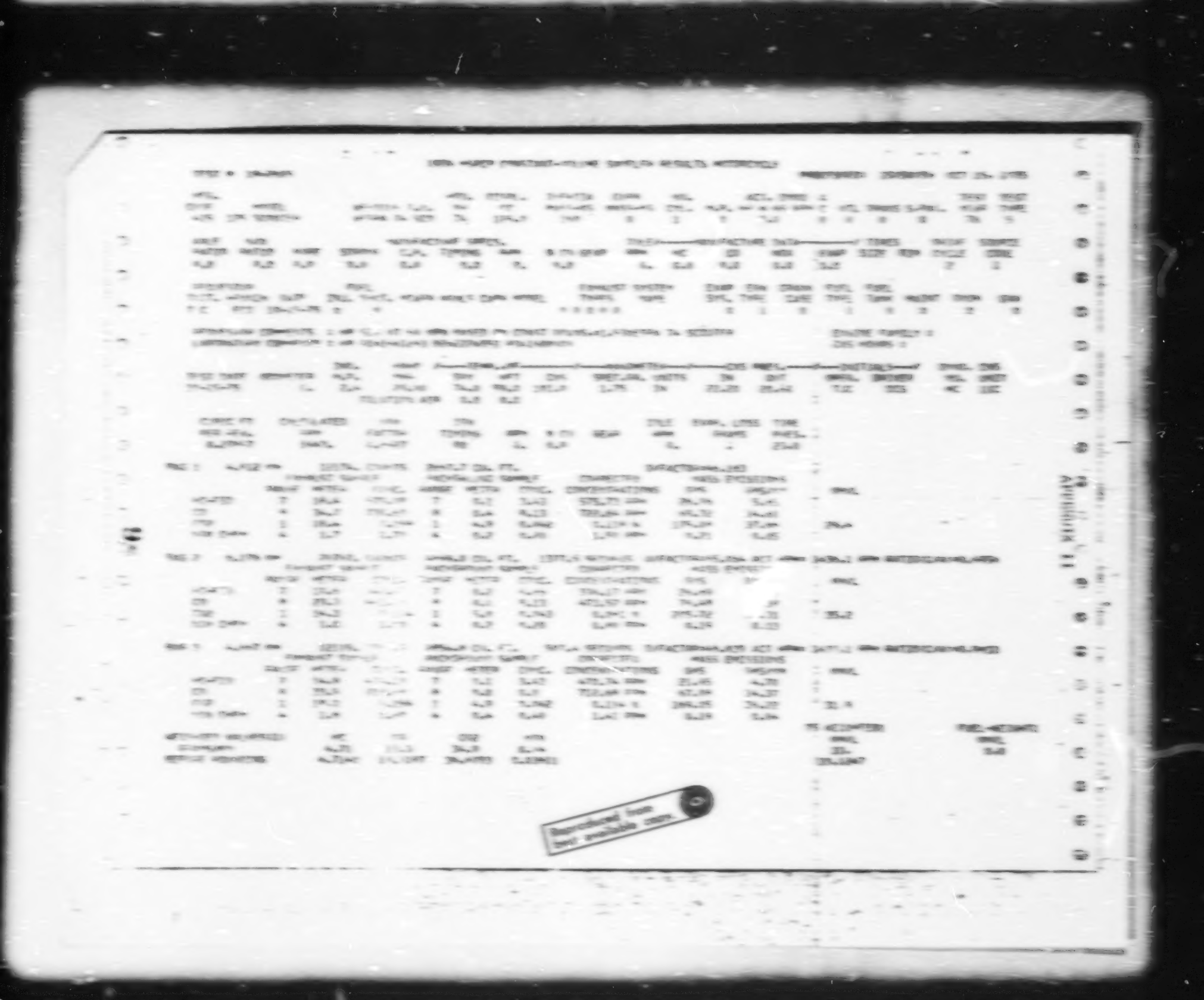
Type	2 cycle, horizonal single cylinder
Bore X Stroke	55 mm x 51 mm
Displacement	121.17 cc
Compression Ratio	8.2:1
Maximum Power	Specified as less than 5 hp (3.7 KW)
Fuel Metering	1 barrel carburetor
Fuel Requirement	Petrol with a 2 percent mixture of 2 stroke motor oil (RON not specified)
Cooling	Air cooled by centrifugal fan

DRIVE TRAIN

Transmission Type	4 speed manual
Final Drive Ratio	5.31:1

CHASSIS

Type	Monocoque type of pressed steel sheet
Tire Size	3.10-10"
Tire Pressure	Front 123 kPa (17 PSIG)
	Rear 157 kPa (22.7 PSIG)
Weight As Tested	162 Kg
Inertia Weight	160 Kg



Appendix B

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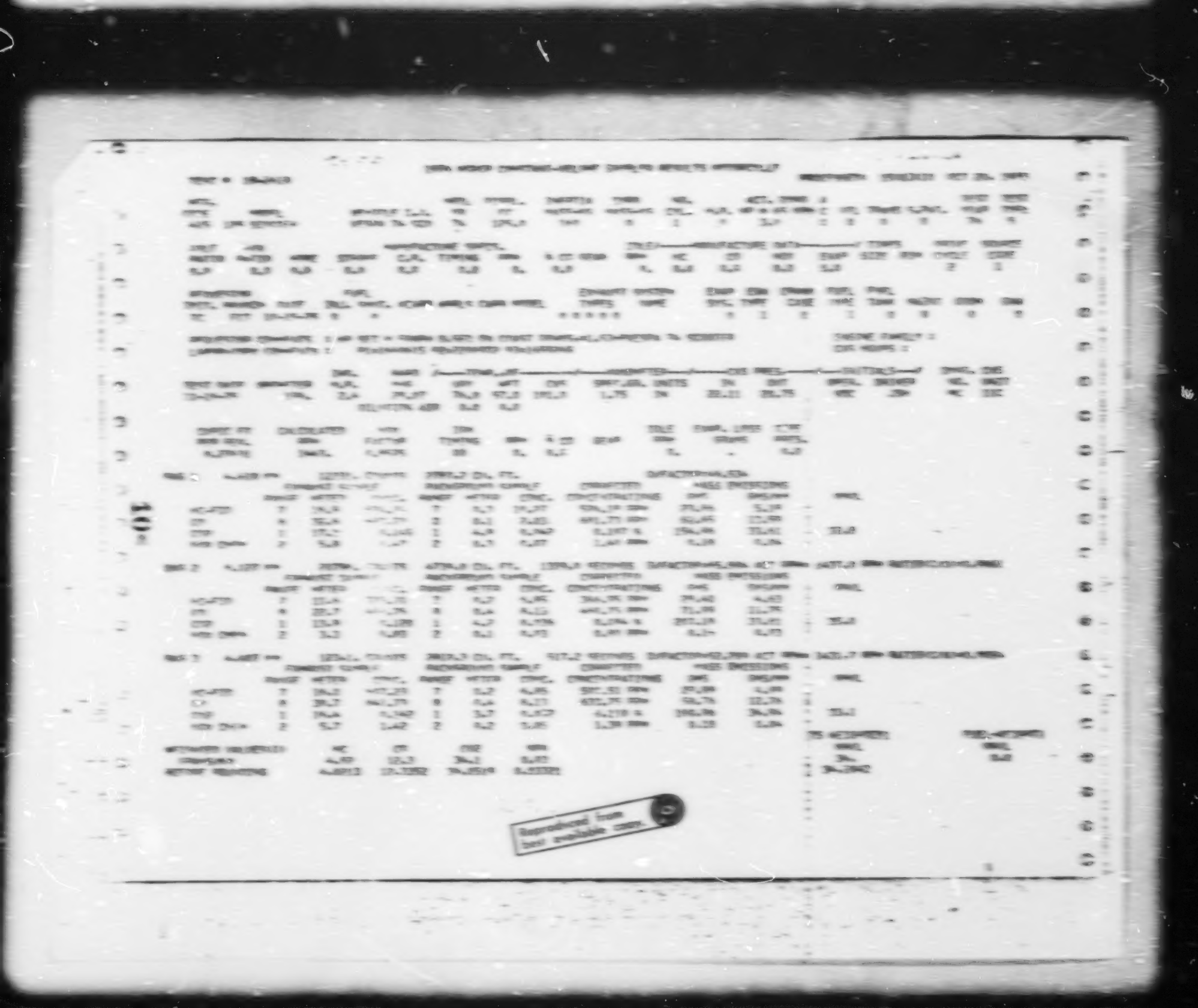
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